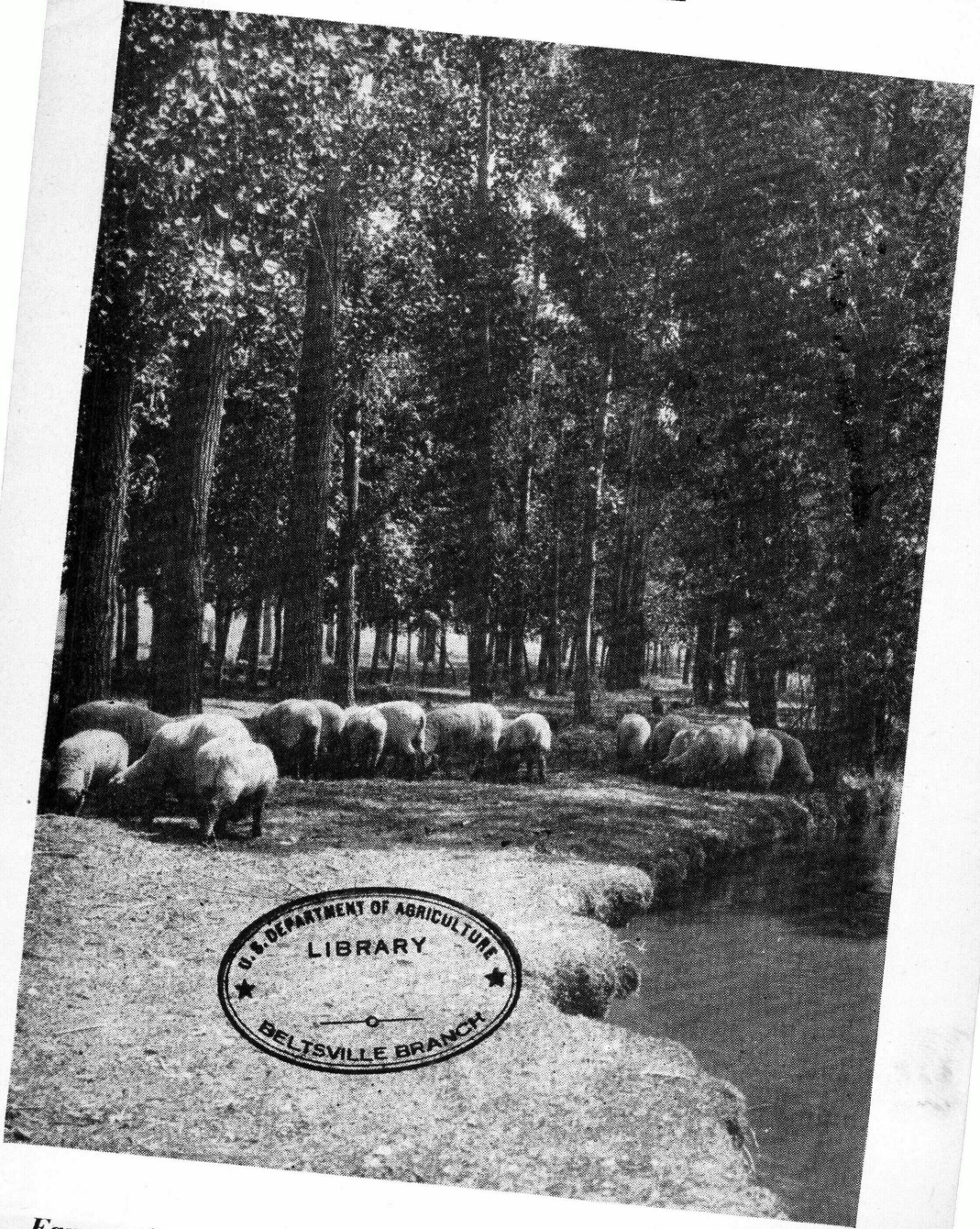


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GRADING WOOL



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U. S. DEPARTMENT
OF AGRICULTURE

GRADING WOOL

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MOST WOOL GROWERS, especially those with small flocks, need to have more definite information on the grade of the wool they have to sell and its value. On the other hand, the buyer usually is well informed as to the market and knows values by grades. It is, therefore, to the advantage of wool producers to learn what they can about the grade and quality of their clips. This bulletin suggests how to go about learning something of grades.

THE WOOL-GROWING INDUSTRY

It is estimated that in 1940 there were about 500,000 wool producers in this country and about 52 million sheep.

The wool clip of the United States has recently averaged about 350 million pounds of shorn wool a year. In addition to shorn wool, from 60 to 65 million pounds of pulled wool is produced annually, which is obtained from the skins of slaughtered sheep.

The wool-growing industry in this country has shifted westward until now three-fourths of the shorn wool is produced in the western sheep States, Texas and South Dakota. Texas is the largest producer.

In the East sheep are raised usually in small farm flocks of from a dozen to possibly a hundred head of shearing age. Such flocks are common as adjuncts to general farming, serving to utilize hill pasture and rough forage.

In the western range States, often called the "territory" States in the language of the wool trade, the sheep as a rule graze over the open range country both in winter and summer. They are run in bands of about 1,000 to 2,000, each band of that size usually having a herder. The sheep raiser in the range States will clip from a minimum of about 5,000 pounds up to as much as 400,000 to 500,000 pounds. Usually the clip runs from 25,000 to 100,000 pounds. In other words, in the West sheep raising is a large-sized business, whereas on eastern farms it is a minor enterprise.

Relatively little wool is produced in the Southeastern States.

Washington, D. C.

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Rambouillet or Merino blood is present in some degree in most of the sheep that produce the territory wool, grown in the Rocky Mountain States. Generally speaking, these wools are of the fine-wool type. In this region is produced most of the American wool.

East of the Rocky Mountains and east of the Edwards Plateau region of west Texas the Down breeds of sheep predominate and the wools are of a coarser type. Exceptions to this are the wools produced in parts of southern Ohio and adjoining Pennsylvania and West Virginia, which are fine wools.

Territory wools shrink more (lose more weight in scouring) than do the eastern wools; and they are not so strong in staple as the latter,



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FIGURE 1.—Shearing in such a way as to obtain an unbroken fleece.

because of the influence of sparse forage and the alkali and dust picked up by the sheep as they graze.

Wools produced in the eastern farm States are called bright domestic fleece wools because they are but little discolored by foreign matter and as a rule shrink uniformly.

The shearing season in the United States usually begins in February in the Southwest, particularly in Arizona. As the weather becomes milder, during May and June, shearing gets well under way throughout the country, except in the North, where it is done during July. Proper shearing, preparation, and care of the fleeces are important points in marketing (figs. 1, 2, and 3). Shearing generally is done only once a year in the United States, but in California and Texas some sheep are shorn both spring and fall.¹

¹ For brief suggestions for the best ways of preparing wool for market see *Preparing Your Wool for Sale*, release of Office of Marketing Services, War Food Administration.



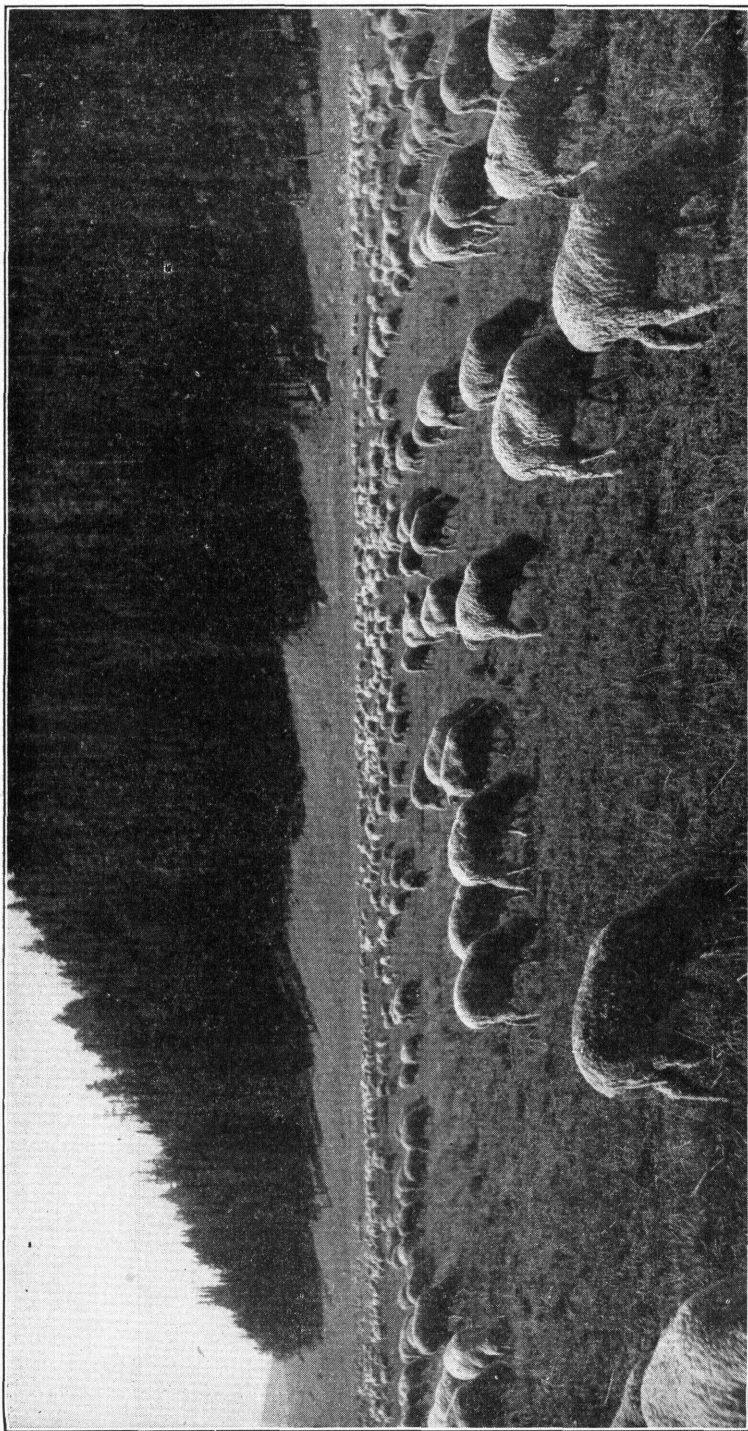
FIGURE 2.—Best position for sheep during removal of fleece.

OMS8663A



FIGURE 3.—A finished, well-prepared fleece.

OMS8668B



FS 47373

FIGURE 4.—A range flock.

IMPORTS OF WOOL

Only about 60 to 70 percent of the wool consumed in the United States is produced here. Some 30 to 40 percent must be imported.

Foreign apparel wools imported into this country pay, at present, a duty of 34 cents a pound, on the basis of the yield or scoured content.

As the United States produces little or no wool that is suitable for carpet or floor coverings, wools for this purpose are admitted duty-free. Such wools must be below a certain grade which is defined in the Tariff Act.

Wools from Australia and South America usually are very well graded and prepared for market and are preferred by certain manufacturers.

The chief ports of entry for foreign wool are Boston, New York, Philadelphia, and San Francisco. During the year ended December 1940 approximately 223 million pounds of apparel wool and approximately 135 million pounds of carpet wool were imported into the United States.

QUALITY OF WOOL

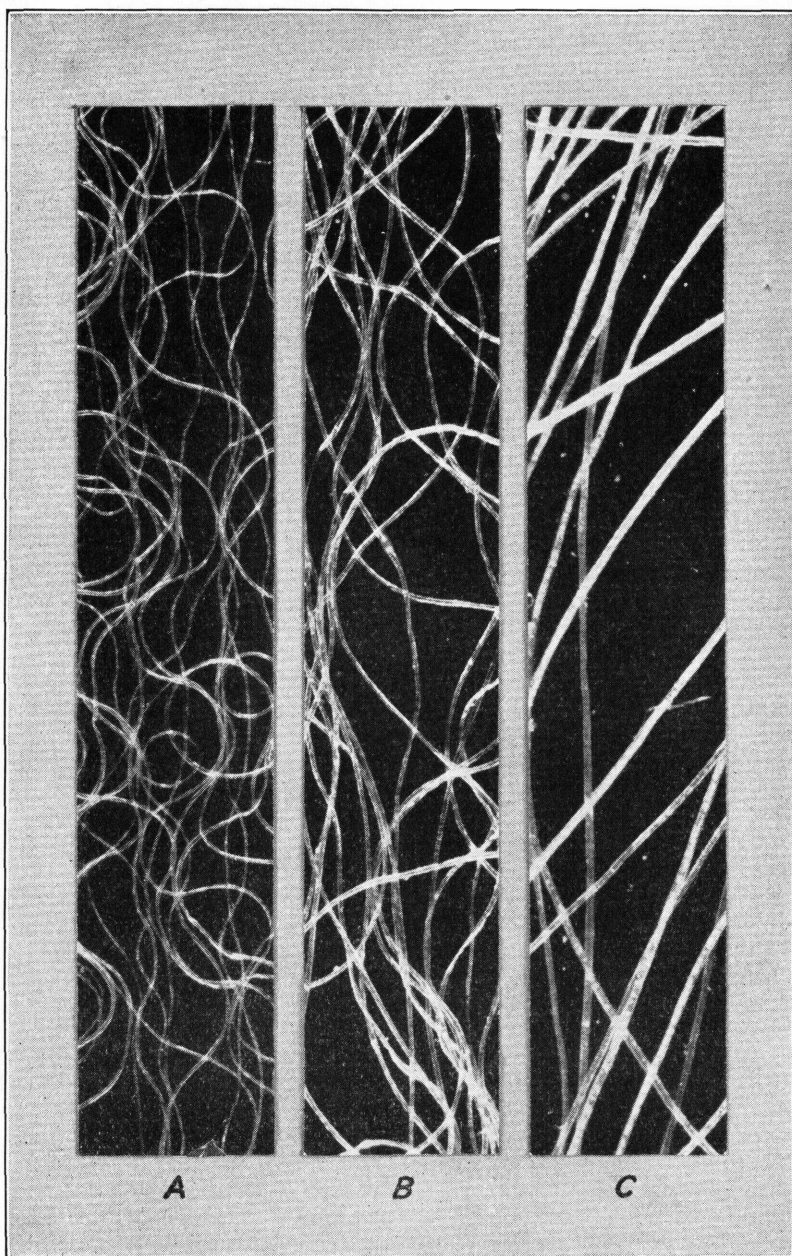
No two fleeces of wool are alike. Furthermore, no single sheep will grow wool of the same character throughout, and fleeces from the same breed of sheep differ widely in many respects.

The characteristics or properties of wool that determine its value to the manufacturer are: Fineness or diameter of fiber, length of staple, strength, elasticity, crimp, softness, pliability, uniformity, color, luster, felting property, and spinning and working properties.

The fineness of wool is very important because the character of the yarns and fabrics produced is determined to a great extent by its variations in the diameter of the fiber. An ordinary sample of wool is not made up wholly of fine, medium, or coarse fibers; it is a mixture of a large number of each, but finer fibers and more of them occur in fine wool; medium fibers predominate in medium wool; and coarse fibers predominate in coarse wool. Fine wool is much more uniform than coarse wool. The value of fleeces varies chiefly according to whether the wool is fine, medium, or coarse (fig. 5).

Length of staple is also very important to the manufacturer. Fibers need to be of a uniform length, for it would be impossible to comb a uniform top (combed wool) or to spin yarn of even smoothness from wool containing both long and short staples.

Wool staples vary in length from about $\frac{1}{2}$ inch up to 12 or 15 inches. They are divided broadly into two main groups, according to their adaptability to certain manufacturing processes. One group is known as the combing wools, and the other is known as carding or clothing wools. In the process of grading they are further divided into the following subgroups: Fine staple, strictly combing, baby combing, french combing, clothing, and stubby.



OMS 8592

FIGURE 5.—Typical wool fibers of different grades: *A*, Fine wool; *B*, Quarter-Blood wool; *C*, Braid wool. (Magnified.)

In one of the first processes of worsted manufacture the fibers are put through a combing machine, which arranges them in parallel position and combs them together into a long ropelike strand which is known as wool top (fig. 6). Carding or clothing wools are too short to be combed satisfactorily. Combing wools and the resulting tops are used especially in the manufacturing of all kinds of worsteds, which require relatively smooth, twisted yarns. There are two systems of worsted manufacture, the Bradford and the French. The former requires wool of long, sound staple. The latter can use staple that is as short as 1 inch, although it is not the general practice to use wools that do not have a length of at least $1\frac{1}{4}$ inches. Carding or clothing wools generally are carded and spun into soft, fuzzy yarns, which are used chiefly in soft woven fabrics.

The natural color of wool is usually called white. It is not a pure white—in most cases it is really a cream color. The shade of cream color that a fleece acquires depends on whether the grease or yolk is of a light or dark color. Wool is said to be white when it is comparatively free from the darker tint.

White wools take the dye well in textile manufacturing. Dark-colored wools, ranging from gray to brown or black, are not so valuable as the white wools. A color defect which amounts almost to an impurity is the mixture of black fibers through a white fleece. Such a fleece cannot be sold as white wool; it cannot be used in the manufacture of white fabrics because the black fibers will show in white fabrics or those that are dyed a light shade.

The other characters of wool already mentioned play their part in making it of value for the manufacture of a given fabric. Strength, elasticity, crimp, and softness are all taken into consideration. The working property of wool is important, and good wool is that which can be carded, combed, spun, felted, woven, and knitted without undue loss or waste.

Wool that has been exposed to the weather until it is rough and dry and tangled by the wind is likely to waste in manufacture and is deficient in good working properties.

GRADES

Ordinarily wool, as it comes from the sheep's back, contains a large quantity of natural grease, dried perspiration, soil, sand, vegetable matter, etc. In this condition it is known as grease wool or wool in the grease (fig. 7). This foreign matter must be removed before the wool can enter the manufacturing processes. This is usually done by scouring the greasy wool in a water with a soap and soda solution. If the wool contains an excess quantity of vegetable matter it must be cleansed by being carbonized.

Wool in the grease is the ordinary raw wool bought and sold in commerce the world around. In this country the ordinary course of marketing is for the fleece to be sold by the grower to a local dealer or to be consigned to a commission dealer in one of the large cities; in certain instances it is sold directly to the manufacturer. Some 35 to 40 million pounds of wool are marketed annually through co-operative associations, which sell it chiefly to manufacturers.



OMS 9338
FIGURE 6.—A ball of top. This ropelike strand is composed of only the longer fibers, which have been arranged parallel by the combing operation.

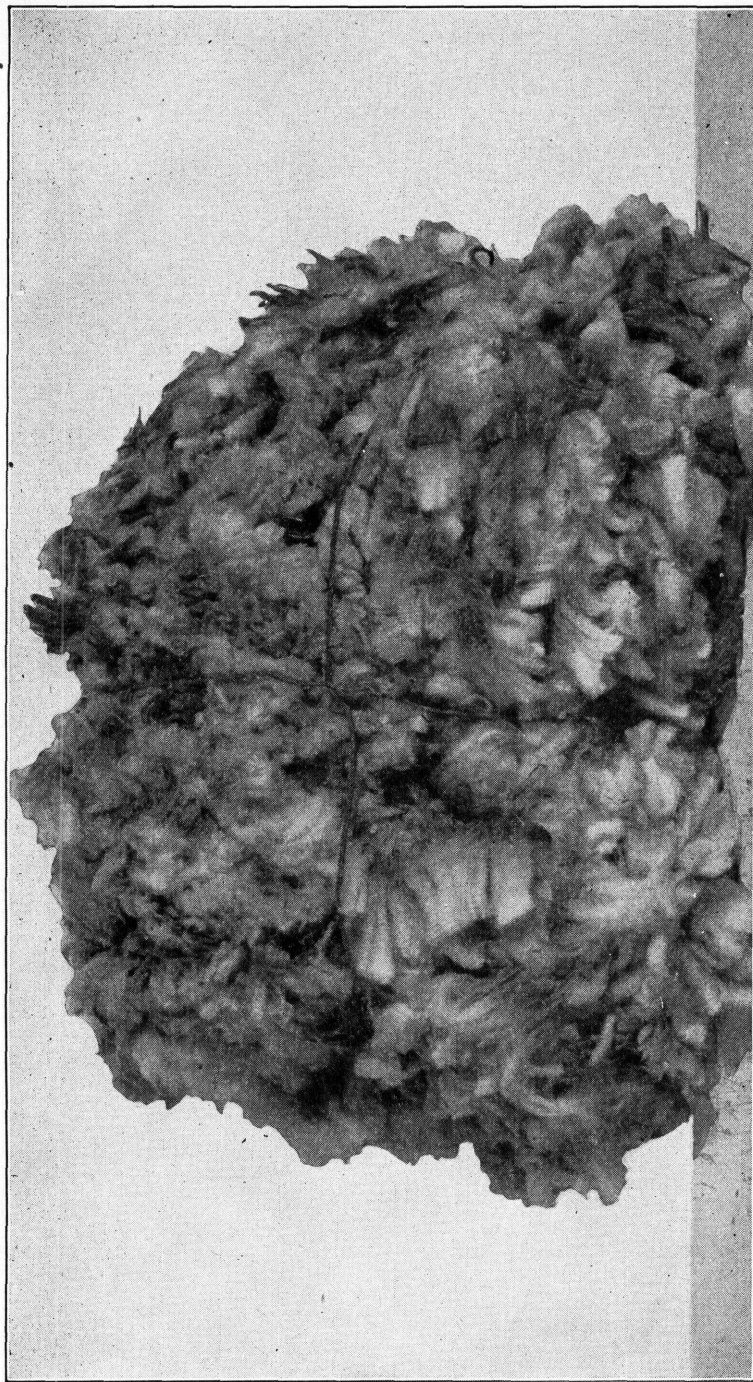


FIGURE 7.—Grease wool, greasy wool, or wool in the grease. Wool as shorn from a sheep.

OMS 9356

Wool is unlike most other important agricultural commodities produced in this country in that there is no established public market for it. Although from 550,000,000 to 650,000,000 pounds of wool, with a total value of from \$150,000,000 to \$300,000,000, are handled annually in this country, there is no public market where it may be traded in as cotton, wheat, and other farm products are sold. Practically all of it is bought and sold privately, and a large part is merchandised through only a few central markets. The marketing of wool is more concentrated than the marketing of many other important farm products.

When the raw wool is assembled by a dealer, say, in Boston or some other market center, it is graded. Manufacturers of various fabrics wish to buy raw wool of certain grades that meet their particular needs.

Some clips, notably those from Texas, are so uniform that they are sold in the original bags, and manufacturers are glad to buy such wools as they come from the producer (fig. 8). The great bulk of wool, however, is graded by the dealers or cooperative marketing associations before it is sold to the manufacturers.

Grading is done by experienced men who can tell by the looks and feel of the wool how to grade it. They separate it into groups or piles having the greatest possible uniformity in fineness and other characteristics. It is this grading process which makes it possible for the manufacturers to buy wool suited to their individual needs; it also makes it possible to quote commercial market grades in terms that can be understood by the entire trade.

The grading system that has been long used in this country is the so-called "blood system." This originated in the early days of the sheep industry in this country. Merino wool was called Fine. All other wools were ranked according to their relative degrees of coarseness as compared with Merino. Presumably the terms used to designate the wool originally indicated the fractional quantities of Merino blood in the sheep that grew the wool of those types.

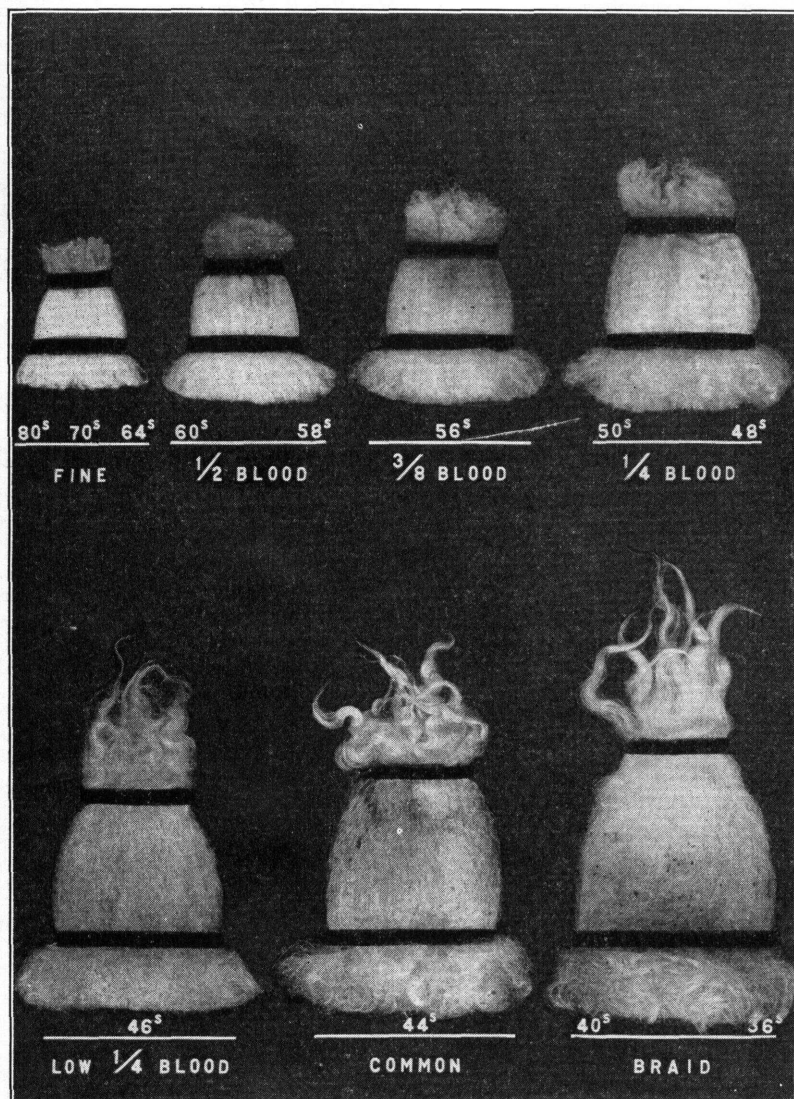
Whatever their origin, the grades that were developed were, and are now, called blood grades (fig. 9). In this American system seven grades are commonly now used. Five of them reflect the blood method of determination. They are: Fine, Half Blood, Three-eighths Blood, Quarter Blood, and Low-quarter Blood. The two coarsest grades now in use are Common and Braid, which apparently have no relation to the blood system.

The grade names as now used do not hold their original significance, for many wools of Half Blood, Three-eighths Blood, Quarter Blood, etc., are shorn from sheep that may or may not contain any trace of Merino blood. Fine-grade wool is grown today by Merino and Rambouillet sheep. Half Blood grade is grown by sheep having considerable Merino and Rambouillet blood. The next two grades, Three-eighths and Quarter Blood, come from Southdowns, Shropshires, Hampshires, Dorset, Cheviot, and Oxford. Low-quarter Blood, the next-lower grade of wool, comes largely from Oxford, and some of the coarse-wool breeds. Common is the next-lower grade, and Braid is the lowest and coarsest. Wool of these two grades comes largely from Lincolns, Leicesters, and Cotswolds.



FIGURE 8.—Original bag wools being examined by a prospective buyer.

OMS 14292



OMS 1562

FIGURE 9.—Grades of wool as represented in the practical forms of the official standards for grades of wool are designated by the blood terms as well as by the corresponding numerical terms.

The English system of grading uses a numerical scale in which the finest wool is designated as 80's and the coarsest wool as 36's. Theoretically the numerals used to designate these grades signify the spinning capacity of wool that has been carefully selected for this purpose. For example, a 60's grade of wool when processed and spun to capacity would result in 60 standard hanks of yarn which would weigh approximately 1 pound, and 80's grade of wool would make 80 hanks, etc. The numerical system of grading is in general use not only in England but throughout the world in the international wool trade.

The following list gives a fair idea of the corresponding grades in the American and English systems:

American:	English:
Fine.	80's, 70's, 64's.
Half Blood.	60's, 58's.
Three-eighths Blood.	56's.
Quarter Blood.	50's, 48's.
Low-quarter Blood.	46's.
Common.	44's.
Braid.	40's, 36's.

Not only does one fleece contain more than one grade of wool, because of the variations in the diameter of the fibers, but often there are variations in diameter from the base to the tip of the fibers (fig. 10). The wool grader must be able to detect these variations and decide within what limits they will fall before he can grade the wool with reasonable accuracy. As a rule the work of the experienced grader is exact enough to satisfy buyers and sellers.

Satisfactory grading requires training, skill, and careful judgment on the part of the grader. As there is no mechanical device suitable for rapid measurement of the diameter of the fibers, the grades are determined by sight and touch (fig. 11).

A good light is essential to correct grading. Northern daylight is best, without either direct sunlight or artificial light. Under too strong light the fibers are likely to appear distorted and irregular, and the essential thing in grading is to differentiate readily between diameters.

In grading wool more attention is generally given to the diameter of the fibers than to the other factors. However, these other factors affect the value of the wool and must be given due consideration. No grading is complete until the wool has been judged according to such factors as the condition of the fleece, length of staple, and strength and character of the fibers. Shrinkage (loss in scouring) is not a grade factor, but it is highly important when the value of the grease wool is being appraised.

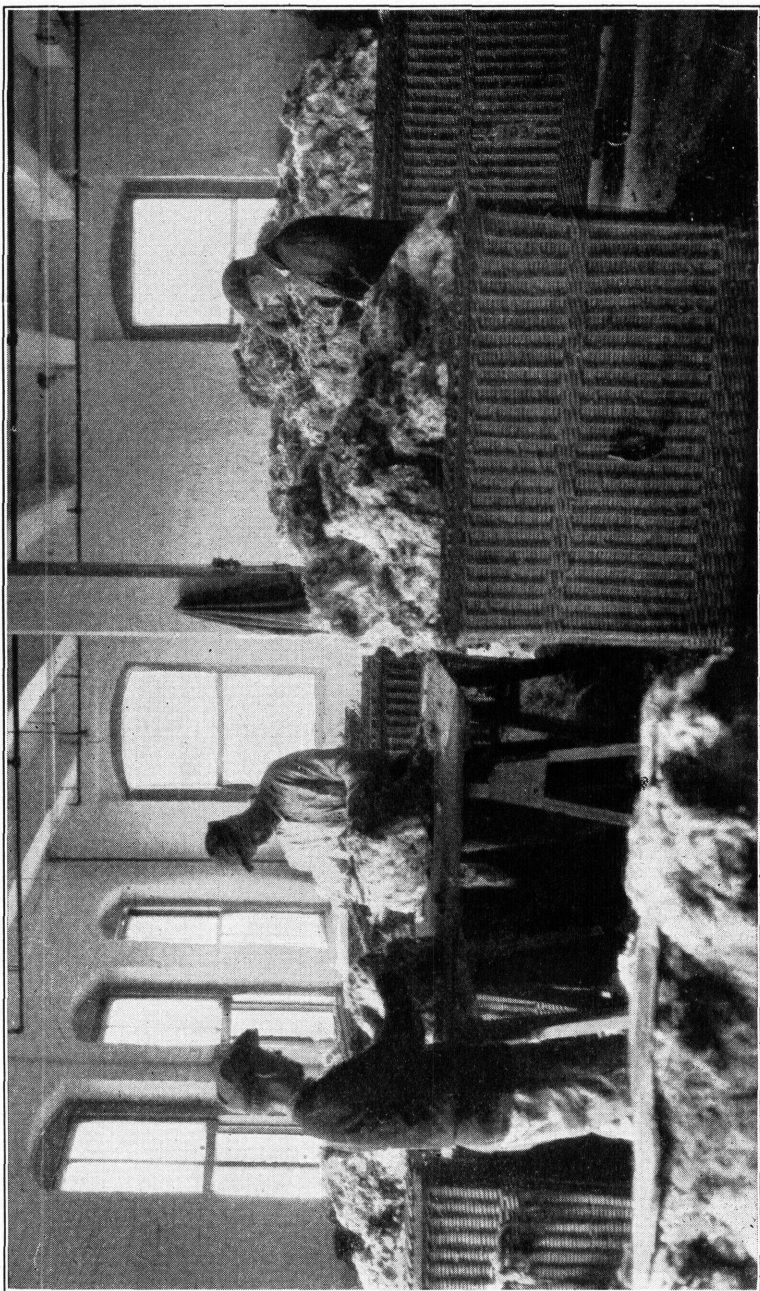
CLASSIFICATION OF WOOL BY REGIONS

In market practice the trade freely identifies wools with the States or regions in which they were grown because the character and appearance of the wool often are affected by conditions in those areas. At least four major regions of the United States so affect the character of the wools grown therein as to distinguish them from wools grown in other regions. Grease wools grown in these different regions differ in condition, shrinkage properties, and color because of differences in soil, in grazing and climatic conditions, and in husbandry practices.



BA 114D

FIGURE 10.—Wool fibers showing variations in diameter. (Magnified.)



OMSI4293

FIGURE 11.—Grading wool.

These variations often affect materially the market values of the grease wools, even of the same grade. In recognition of this fact, the wool trade has broadly classified domestic wools into four general groups based on areas of production, as follows: Territory wool, semibright wool, bright wool, and southern wool.

TERRITORY WOOL

That part of the domestic clip produced west of the one hundredth meridian is known in the trade as territory wool and is produced in the States of Washington, Montana, Idaho, Wyoming, Nevada, Utah, and Colorado, in the western halves of North Dakota and South Dakota, and occasionally in western Kansas and Nebraska.

Sheep in the "territory" States graze over wide areas and are subject to widely varying soil, climatic, and grazing conditions, and usually are without protection from the weather. All of this affects the quality and shrinkage properties of wools.

Wools grown in Texas, California, and Oregon are generally known by the name of the State in which they are produced. Arizona and New Mexico wools also are generally classed separately because wools from these States have peculiarities that distinguish them from wools from other States and regions.

SEMIBRIGHT WOOL

Wools produced in Oklahoma, in the eastern parts of Kansas, Nebraska, South Dakota, and North Dakota, and in parts of Missouri, Iowa, Minnesota, and Wisconsin have a dark or stained color caused by deposits in the fleeces of bits of the soil. The fleeces thus affected appear dirty and unattractive, but they scour out white.

Semibright wools often are grouped and graded with territory or with bright wools, according to their predominating characteristics.

BRIGHT WOOL

Bright wools are produced in the States east of the territory and semibright areas, extending to the Atlantic seaboard. These wools are less exposed to colored soils and other foreign matter than are those in various western areas, so the fleeces are much cleaner and brighter. Such wools have fairly uniform shrinkage, whereas wools from the semibright and territory regions have widely varying shrinkages.

SOUTHERN WOOL

Wools grown in the Southeastern States are of bright color and in this respect are similar to bright wools produced in the States east of the territory and semibright regions, but they are designated by the trade as southern wools. Many so-called southern wools are inclined to be brashy, run-out, and uneven, as they are shorn from sheep belonging to no particular breed or class.

In some of the Southern States, however, especially in Kentucky, Virginia, and Tennessee, where better strains of sheep are raised, some choice wools are produced that grade Three-eighths and Quarter blood. Very little wool of the Fine grade is produced in the Southeastern States.

"OFF" WOOLS

"Off" wools are defective fleeces; they are otherwise known as discounts, rejections, or unmerchantable wools. Among the wools that are generally classified by the trade as off wools are fleeces in the following conditions: Burry, seedy, chaffy, cotted, black and gray, dead and murrain or merrin, and tags (fig. 12).

Burry, seedy, and chaffy are descriptions applied to wool which has excessive quantities of burs, seeds, chaff, or other vegetable matter entangled in the fibers. When this condition exists additional chemical or mechanical treatment is necessary.

Cotted fleeces are those in which the fibers have become badly tangled or matted. "Hard cots" or "soft cots" are terms denoting the degree of tangle or mat in the fibers. (The English form is cotts.) Special mechanical treatment is usually necessary to open these fleeces when preparing them for the manufacturing processes.

Black and gray are the terms used in the market to describe colored wools. The first is usually applied to that which is nearly all black, and colored fleeces containing relatively large quantities of white, brown, or gray wool are designated by the last term.

Dead wool is wool that has been clipped from sheep shortly after their death. When wool is recovered from decomposed remains found on the ranges, it is designated by the term "murrain" or "merrin."

Tags are parts of the fleece heavily matted with dung and other animal or vegetable impurities. The term "tag locks" is sometimes applied to such discount wool.

Off wools are always of inferior quality, and the quality of many of them is further impaired by the severe cleaning processes necessary to put them in usable condition.

WOOL GRADING AND THE FARMER

A knowledge of grading is of value to the wool producer in at least three ways. (1) It enables him to understand the current market quotations, for prices are quoted ordinarily according to commercial grades. (2) It tends to put the grower on a more even footing with the buyer (who is always inclined to protect himself in his estimate of shrinkage) in regard to the percentage that the clip will run by grade and the proportion of black, burry, and seedy wool present. (3) An accurate knowledge of grades serves as an excellent check on any deterioration of a grower's fleeces or brand. It becomes a guide for breeding operations with respect to either individual sheep or the entire flock.

Grading wool means grouping individual fleeces according to a definite type. The degree of fineness of wool, based on diameter of fiber, is the most important single consideration; it affects materially the products made from the wool and therefore the value of the wool.

Wool manufacturers generally require and buy only specific grades of wool for their individual needs. Although the wool is often graded more closely to suit the special needs of certain manufacturers, the ordinary practice is to grade it in accordance with general mill requirements. During the process the fleeces are put in groups or piles which will be reasonably uniform in all the essential characteristics of each fleece. These units or piles are called graded fleeces (fig. 13).

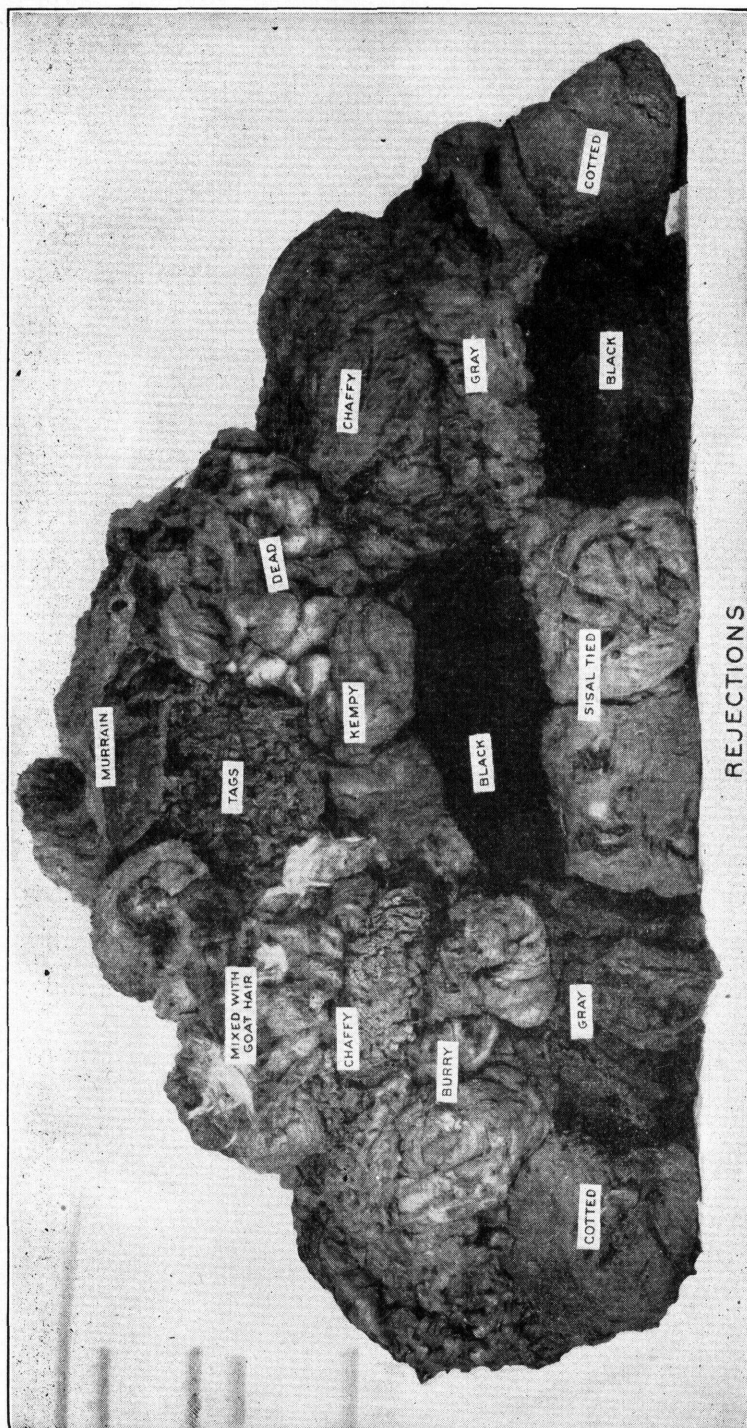


FIGURE 12.—Off wools—discounts, rejections, or unmerchantable fleeces.

OMS9358



FIGURE 13.—A pile of graded Three-eighths Blood combing fleeces.

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The grading of wool, as now practiced, can be learned accurately only by closely observing demonstrations and through experience. It demands trained judgment in respect to qualities, and quality must be ascertained by the actual look and feel of the wool.

Accordingly, this bulletin must be limited to explanations and cannot be expected to tell the farmer exactly how to grade his wool; but the fact remains that some practical knowledge of wool grades is decidedly useful to one having any considerable quantity of wool to sell. Few growers are familiar enough with the grades of wool to get full information regarding the value of their wool from market quotations. Those who are reasonably familiar with the characteristics that make for value are in better position to interpret quotations and to market their clips advantageously.

Whether the grading of wool at the source, at time of shearing, will or can become a universal practice is a question that cannot be answered here. There are reasons why it would be advantageous to growers; but a very much larger number of skilled graders would be required than are now available. Wool badly graded never will be acceptable in the channels of trade; commercial grading is, after all, a job for trained and experienced men. If grading at the point of origin does become a general practice, the use of a single standard for grades of wool will be necessary in order that wool in each grade may be uniform and that more confidence in such grades may be established.

There is general agreement among wool men that it is desirable to make at least some division in fleeces in respect to grade, at the time of shearing. There is, however, no agreement concerning the closeness with which the grading should be done or the number of grades that should be used. Some think that merely a separation should be made of the rejections, such as the black and the burry fleeces, the dead and the cotted wool, the tags, etc. Others think that the wool should be graded at the shearing pen into the grades that are used in the market centers. It is doubtful whether a sufficient number of experienced graders are available to make the plan feasible as yet. On the other hand, the mere separation of the "off" fleeces from the good would not accomplish the end of having the wool so put up as to permit more ready appraisal by grade. Probably there is an intermediate point to which the grading of the wool at the source can be carried with prospects of higher net returns to growers.

The Office of Marketing Services of the War Food Administration has prepared a wool-grade chart (fig. 14) on which seven samples represent the different grades of domestic grease wools, arranged according to their relative fiber diameters. Each sample indicates as nearly as possible the maximum diameter of fiber allowed in its "Blood" grade when taking into account the other factors that influence grade.

This wool-grade chart will be sent on request by the Office of Marketing Services, Washington 25, D. C., to vocational instructors, agricultural leaders, and county agents who wish to illustrate the grades of wool.

One who wishes to make a practical application of the grade illustrated on the chart may do so by comparing staples drawn from fleeces with the samples shown on the chart. He should place the fleece

staple that is to be matched with the chart on a black cloth or cardboard in ordinary daylight (not sunlight). He should spread the fibers apart and examine their fineness. He should also become familiar with the comparative feel of the staples in his fleece samples and those on the chart. He may learn to associate the fiber of a certain thickness with the appropriate grade name. Students have found that measuring the thickness of the individual fibers with a micrometer caliper is helpful when learning to distinguish fineness.

After considerable practice it should be possible to pick out staples from ungraded fleeces and identify them readily as Three-eighths Blood or Low-quarter Blood or Common or Braid.

Fineness or diameter of fiber is the first and most important characteristic. Recognition of this property of wool cannot be taught on paper. A man can become familiar with the different grades only by personal study of actual wool samples.

Once a person has a fairly good idea of the different degrees of fineness, he can examine a fleece, either shorn or on the back of the sheep, and say with some degree of assurance, "This wool will grade Half Blood" or "Quarter Blood," as the case may be. In time, and with sufficient experience of this kind, he can gain a fairly good idea as to how his wool will grade, at least within practical limits.

After the matter of fineness, the next major consideration is the length of staple. Take a fleece, either shorn or on the sheep's back; spread apart the staple; and examine it for length. Graders have a way of taking hold of the end of a staple with thumb and finger and drawing it back over the thumb of the other hand so that its full length lies along the thumb. If the staple reaches to or beyond the second joint, the old "rule of thumb" is that it is combing wool. If it is shorter than this, it is clothing wool, or possibly the length may lie between these two in a class called french combing. Combing wool is that with a staple 2 inches long or more. Clothing wool has a staple under $1\frac{1}{4}$ inches in length. As all wool producers know, the long-staple combing wools bring more money in the market than do the short wools. A knowledge of the worth of his fleeces, if they are of high quality, should mean more money to the grower.

Besides fineness and length of staple, there are, of course, various other factors that affect the value of the fleece. Its color and general condition count for something in terms of price because it is on these things that the buyer forms his judgment as to the probable shrinkage of the wool. Wool that is full of sand, dirt, and various kinds of vegetable matter will have a high percentage of shrinkage, and the buyer will scale down the price he pays enough to protect himself against this shrinkage. On the other hand, the wool may be in very good condition, with the probability of a minimum of shrinkage; in that case it is up to the grower to back his position at the time of sale with a knowledge of the good properties of his wool.

The ability to estimate shrinkage with a reasonable degree of accuracy is something that cannot be gained from the printed page or even by a single visual demonstration. Probable shrinkage is one of those elements in judging wool that can be gaged only after experience and on the basis of a fairly broad knowledge of all the characteristics of raw wool.

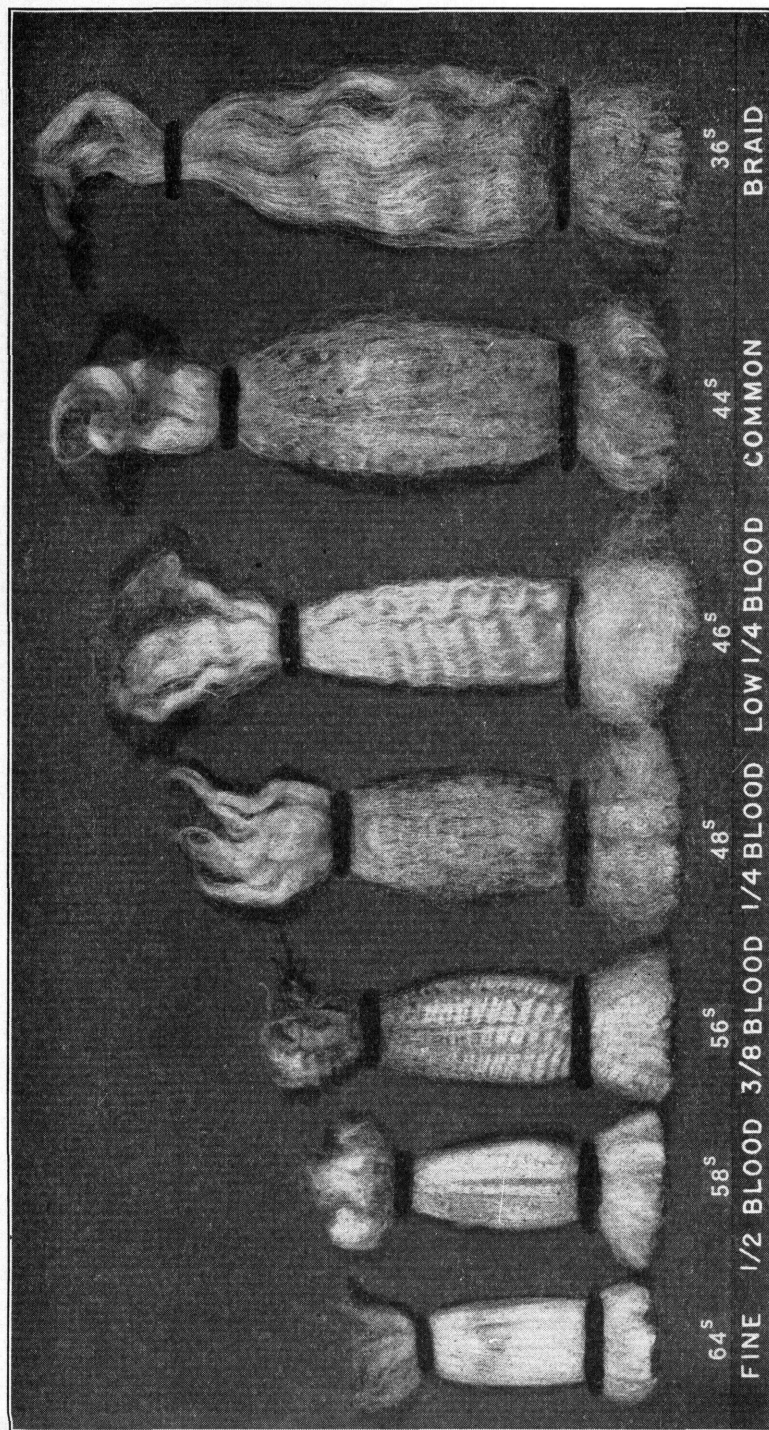


FIGURE 14.—School chart showing samples of the different grades of wool. (Approximation of grades in the official standards for grades of wool.)

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It is a thoroughly practical thing for any wool producer to take the steps here suggested. He can get sample staples, familiarize himself with the degrees of fineness and staple length that go with each of the seven grades, and thus learn a great deal about the quality of his wool. If this is followed up by attending grading demonstrations such as are held from time to time throughout the wool-growing sections, he can become proficient enough in grading so that he will not be at any serious disadvantage in the wool market. Many large producers are finding it worth their while to learn to grade wool in the only way it can be learned accurately—that is, from an experienced grader.

OFFICIAL STANDARDS FOR GRADES OF WOOL

Producers and others agree that there should be a greater degree of standardization than now prevails in the grades used in marketing wool. Such standards provide a common language for producers and the trade, which will tend ultimately to stabilize the wool market and provide a basis for the dissemination of reasonably accurate market information.

To meet this need, the United States Department of Agriculture has developed the seven grades of domestic wool, ranging from Fine to Braid, which were established some years ago as the official standards of the United States for use in merchandising wool. There is nothing compulsory about these standards. Their use is voluntary or permissive.

The official type samples which were established to illustrate these grades show as nearly as possible the maximum and the typical diameters of fibers permissible in a given grade of domestic wool. In recognition of the established custom in this country, the blood system of terminology is used in these standards to designate the seven grades (fig. 9). They are applicable in grading fleeces at shearing pens and at central markets.